LIFE Project Number

LIFE15 ENV/GR/000257

LIFE PROJECT NAME or Acronym

LIFE-F4F (Food for Feed)

Annex Data	
Action:	C1 Monitoring of the impact of the project actions
Partner:	ALL PARTNERS
Deliverable:	C1.3 Impacts of the project if a full scale unit will be developed

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1. Introduction

Within the F4F project's progress, it is scheduled to reduce the distance between the demonstration unit (pilot unit) and a full scale unit to be developed. In order partners to be able to move on with this next step of the project, and by utilizing all the results and their experience from the project's implementation, they have worked in order to develop series of engineering and operation documents and designs. A variety of parameters are needed, such as environmental and socio – economic impact to the local economy and population, during the project's pilot implementation and in order to prepare the full scale F4F implementation.

2. Impacts of a full scale unit

The main key of this report is the assessment of the project's realization in a variety of parameters, taking into consideration the output of the project's realization, in case of a full-scale implementation. After the project's end and in case of the project's continuation, replication and/or transfer level partners estimate that food waste collected quantity will be possible to approach 10,000 – 13,000 metric tonnes. In case where a commercial unit with capacity of 10,000tn per year will be developed, it is estimated that more than 50 hotels with about 500 beds and more than 25 supermarkets could manage their food waste and collaborate with this unit and more than 3,000tn of feed (a product with high added value, which it will be used as a component in animal feed) will be produced. In addition, at least 30 relevant to the feed production and consumption businesses will be affected.

The impacts of this action are presented in the following paragraphs.

2.1. Environmental impact

In the EU it is estimated that 88 million tonnes of food wastes are produced every year, an equivalent of 179 kg per person. In Greece, in 2018 almost the 80% of food wastes (~135 kg/ca/y) is still disposed in landfills, either directly or indirectly. Also, the quantities of food residuals that they are lost in agricultural production or wasted in the wholesale/ retail sector-because they are not commercially acceptable (wrong shape and color, damaged etc.), have not been quantified.

The decomposition of disposed food residues in a landfill is estimated that generates between 120 and 220 cubic meters (m^3) of biogas (carbon dioxide and methane), which corresponds (if the biogas consists of 53% CH_4 and 47% CO_2) to the emission of **1.540** tonnes of carbon dioxide equivalent (t eCO_2) per tonne of food residues (tFR) disposed and **2.545** tonnes of carbon dioxide equivalent per tonne of food residues (FR) disposed, respectively.

The F4F process is estimated that emits **0,192** metric tonnes of eCO_2 per input tonne of food residues dried and thus this value extracted from the GHG emissions due to diversion of the food residues from disposal to landfill.

The benefits in terms of climate change of a full-scale F4F facility with a capacity of processing 10,000 tonnes of food waste (FW) annually, whereas it is expecting to produce 2,500-3,000 tonnes of dried feed are estimated below, assuming the lower value of eCO_2 generation.

eCO_2 emissions of landfilling: 1.540 tonnes eCO_2/ t_{FR} landfilled.

eCO_2 emissions of F4F process: 0.192 tCO_2/t_{FR} processed.

Net eCO_2 emissions of food residues diverted to F4F process = (0.192-1.540) = **-1.348** tonnes $eCO_{2(eq)}/t_{FR}$.

So, the processing of 10,000 tonnes of food waste in a full-scale F4F facility, and thus diverting from landfill, avoids:

10,000 t_{FR} x (-1.348 tCO_2/t_{FR}) = **-13,480 tonnes eCO_2**,

Reducing this level of $tCO_{2(eq)}$ emissions is equivalent to removing more than **3,600 cars** off the streets of Heraklion for one year. It must also be noted that the above estimated avoided emissions of eCO_2 do not include any additional possible benefits from the avoidance of eCO_2 emissions from the production of the respective 2,500 -3,000 tonnes of feed from crops.

On the top of the environmental issue comes the social and economic ones. With the feed composed mostly by agricultural crops, that are suitable for human consumption, competition results in price increase of crops like corn, making it not affordable from a significant number of people around the globe. In respect, the fact that most feed is imported from outside EU, does effect the food security of Europe.

2.2. Social impact

- ✓ More than 18 new job positions are estimated to develop in the new commercial unit, which in no case will be occurred in case of a conventional way and conventional technology disposal.
- ✓ More job positions in the hospitality sector for the proper waste management (1 position / unit)
- ✓ Provide the source separation scheme that aims in collecting from specific large food waste producers, those streams.
- ✓ General public will be informed about the source separation system (raising of social awareness)
- ✓ More than 100,000 people will be involved, either as waste producers or as end product users.
- ✓ Promotion of social responsibility, supplier relationships, fair competition for food waste suppliers (as hotel managers/owners)

2.3. Economic impact

- ✓ About 3,400,000.00 € up to 4,200,000.00 € will be the required capital investment for the full scale commercial unit of 10,000tn capacity (in case of 3 or 4 units, according to scenarios that have been developed in the business plan).
- ✓ The annual running/operational cost of this unit has been estimated to 400,000.00 € up to 600,000.00 €. This depends on the raw materials sources (points of collection, please for more details see the business plan of the F4F project, Deliverable B6.6.)
- ✓ More than 3,000tn of produced feed will be available in a commercial manner. The sales cost of the produced feed is estimated at about 250 – 350€/tn. This is the economic benefit that occurs from this procedure for waste management bodies and companies. The F4F product can replace about the 10-15% of the conventional animal feed.
- ✓ The replacement of this 15% of the conventional feed will be economic benefit for users (animal owners, or animal products' consumers).

- ✓ The diversion from landfill of about 10,000tn of biowaste from the central waste management system will yield economic benefit to the municipalities (management and land field cost) but also to the producers (through fees reduction).
- ✓ Incorporation of the new Greek Legislation 4819/23.07.2021 and the EU directive 851/2018 on solid waste that promotes the "pay as you throw" system, where municipalities will charge private entities only for the amounts of wastes they handle.

3. **Conclusion**

The development of such commercial F4F units is aiming to contribute to solving, the following major environmental, as well as economic and social problems:

a) the extremely high carbon foot print of animal feed producing process, and the respective animal protein production for human consumption,
b) the pressure that the existing food production system impose to the environment and the ecosystems, including the competition between food (humans) and feed (animals) production systems, and
c) the inefficient food waste management system, from farm to fork, and the EU's aim to transform them in high added values products (see Circular Economy Strategy, Roadmap to Resource Efficient Europe and Waste Directives, 2008 and 2018).

According to the European Commission (Roadmap to a Resource-Efficient Europe) demand for food, feed and fibre may increase by 70% by 2050, whilst 60% of the world's major ecosystems that help produce these resources, have already been degraded or are used unsustainably. Nutritional sustainability is the ability of a food system to provide sufficient energy and essential nutrients required to maintain good health in a population, without compromising the ability of future generations to meet their nutritional needs. Ecological, social, and economic aspects must be balanced to support the sustainability of the overall food system.